



# PATENT SPECIFICATION

197,872

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## COMPLETE SPECIFICATION.

### Apparatus for Carrying Out Highly Exothermic Catalytic Reactions Between Gases, particularly Catalytic Oxidation of Ammonia with Oxygen.

We, IVAR WALFRID CEDERBERG, Ph.D., of 16, Landshuterstrasse, Berlin, Germany, and HELGE MATTHIAS BÄCKSTRÖM, of Djursholm, Sweden, Professor, both subjects of the King of Sweden, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

When carrying out highly exothermic catalytic reactions between gases on a technical scale it is often advantageous that the catalyst zone be divided into a great number of contact units separated from one another, as for instance in the production of sulphuric oxide according to the so-called contact process, in the combustion of ammonia-oxygen mixtures, and in various other reactions. By such division it is possible to obtain within the catalyst zone a distribution of temperature favourable for the progress of the reaction by variation of the activity of the various contact units and by controlling the cooling of the same, and in addition compression of the contact substance and thus a hampered passage for the gases is avoided. When the contact zone consists of a great number of porous plates as contact carriers, difficulties are met with, however, in providing a suitable construction of the catalysation apparatus, partly in view of the fact that a portion of the gas mixture evades reaction by passing through the space between the contact plates and the wall of the surrounding cylinder, which space increases with the heat of the apparatus, and partly in view of the fact that it is difficult to effect an efficient cooling of the contact plates owing to bad conduction of heat.

The present invention relates to an apparatus for carrying out highly

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exothermic catalytic reactions between gases by the use of which apparatus the inconveniences above referred to are avoided and other important advantages are attained. The apparatus according to the invention is characterized by that the catalyst chamber consists of a series of metal rings of such shape that they form annular flanges within as well as around the catalyst chamber and, when pressed together form a gas-tight joint with one another, their tightening faces being preferably conical.

The construction of the apparatus is illustrated in the accompanying drawing which shows the apparatus in longitudinal section.

The catalyst zone which consists of a great number of porous plates 1 of for instance pumice-stone with finely divided platinum precipitated thereon, is located in a tubular catalyst chamber which consists of a series of metal rings 2 of such shape that when pressed together by means of screw bolts 3 and nuts, not shown in the drawing, they will fit tightly. Said rings 2 are suitably of such shape that when assembled with their preferably conical tightening faces against one another they will form annular flanges 4 and 5 within as well as around the catalyst chamber. The first and last rings 6 and 7 of the series are made heavier and are provided with apertures for the bolts 3, and the shape and size of the same are suited to the corresponding flanges on the gas inlet and gas outlet tubes. In the inner spaces between the various rings of the series the contact plates 1 are located which have a shape suited for this purpose.

By the use of the apparatus above described the disadvantages referred to in the opening paragraph are avoided.

Page 2 of 2

The portion of the gas mixture which tries to pass around the contact plates 1 must incessantly change direction and will in this manner come in an intimate contact with the broad upper portion of the plates. The excess heat of reaction is conducted away without difficulty through the metal rings 2 from which the radiation of heat is exceedingly great owing to the particular shape of said rings. The advantage is further attained that each contact plate may easily be exchanged owing to the fact that the catalyst chamber may be taken to pieces, which is important for instance when using contact plates of varying activity. The apparatus described is particularly adapted for the combustion of ammonia-oxygen mixtures. In this case aluminium, or a nickel alloy capable of withstanding the action of nitrous gases, is preferably used as material for the apparatus.

Having now particularly described and ascertained the nature of our said inven-

tion and in what manner the same is to be performed, we declare that what we claim is:—

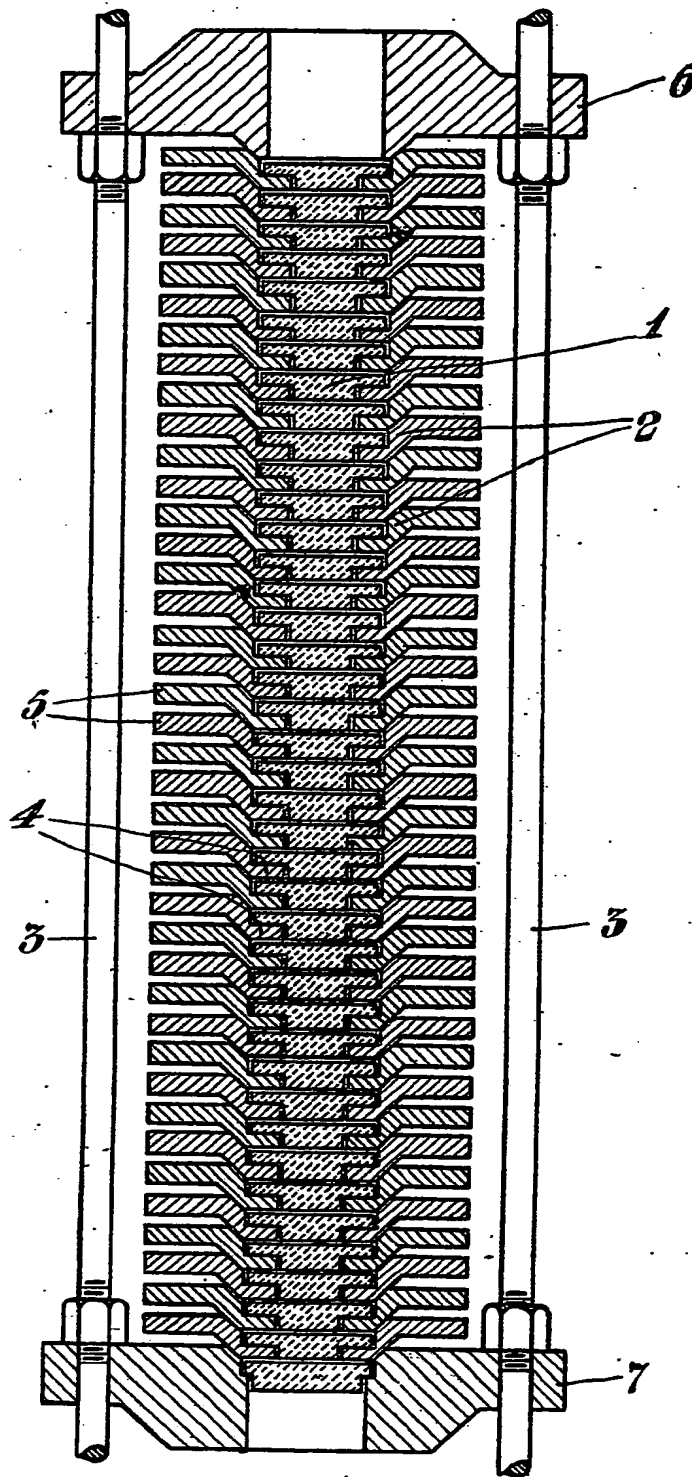
1. An apparatus for carrying out highly exothermic catalytic reactions between gases, particularly catalytic oxidation of ammonia with oxygen, characterized by that the catalyst chamber consists of a series of metal rings of such shape that they form annular flanges within as well as around said chamber, and, when their preferably conical faces are pressed together, make a gas-tight joint with one another.

2. An apparatus for carrying out highly exothermic catalytic reactions between gases, particularly catalytic oxidation of ammonia with oxygen, substantially as described with reference to the attached drawing.

Dated the 14th day of July, 1922.

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2, Norfolk Street, Strand, London, W.C.,  
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[This Drawing is a reproduction of the Original on a reduced scale.]



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